

Abstract

Every community must prepare for and respond to hazardous events, whether a natural disaster like a tornado or a disease outbreak, or a human-made event such as a harmful chemical spill. Communities prepare, respond, and recover unequally in the face of these hazardous events. Factors which contribute to social vulnerability, including poverty, lack of access to transportation, and crowded housing, may weaken a

community's ability to prevent human suffering and financial loss in the event of disaster.

Here we illustrate the Social Vulnerability Index (SVI) and associated tools developed by CDC/ATSDR's Geospatial Research, Analysis and Services Program (GRASP) to help state and local partners identify socially vulnerable communities.



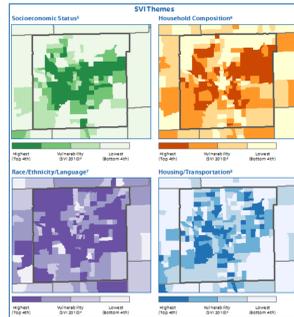
Hurricane Sandy - Breezy Point, NY Photographer - Pauline Tran

A Social Vulnerability Index (SVI) from the CDC

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What is the SVI?

The Social Vulnerability Index uses U.S. Census data to determine the relative social vulnerability of every census tract. The SVI ranks each tract on 14 social factors and groups them into four related themes. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking. The SVI can help emergency response planners and public health officials identify and map the communities that will most likely need support before, during, and after a hazardous event.



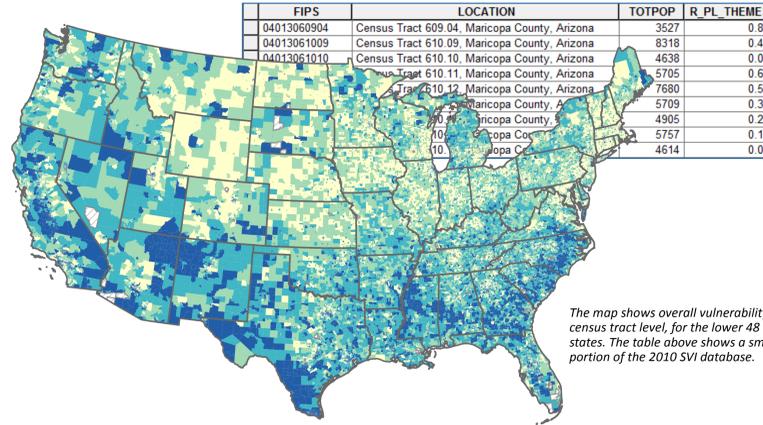
A portion of the Prepared County Map for Marion County, Indiana, showing maps of the four themes.

Overall Vulnerability

Socioeconomic Status	Below Poverty
	Unemployed
	Income
	No High School Diploma
Household Composition & Disability	Aged 65 or Older
	Aged 17 or Younger
	Older than Age 5 with a Disability
Minority Status & Language	Single-Parent Households
	Minority
Housing & Transportation	Speak English "Less than Well"
	Multi-Unit Structures
	Mobile Homes
	Crowding
	No Vehicle
	Group Quarters

Along with the rankings, the SVI databases include all the census variables listed above. Graphic adapted from the North Carolina Preparedness and Emergency Response Research Center.

The SVI databases are in ArcGIS personal geodatabase format (mdb). In addition to ArcGIS, mdb files can be explored in QGIS, Access, and imported into Excel. Documentation is available for all databases.



The map shows overall vulnerability, at census tract level, for the lower 48 states. The table above shows a small portion of the 2010 SVI database.

SVI Website - <http://svi.cdc.gov>

SVI Home Page

A portion of the Prepared County Map for Marion County, Indiana, showing the overall vulnerability.

Portion of an SVI Tract Report

SVI Interactive Map

SVI Uses

The SVI can be used in many ways. Some examples:

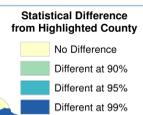
- Estimate the amount of needed supplies like food, water, medicine, and bedding.
- Help decide how many emergency personnel are required.
- Identify areas in need of emergency shelters.
- Plan the best way to evacuate people, accounting for those who have special needs, such as people without

vehicles, the elderly, or people who do not understand English well.

- Identify communities that will need continued support to recover following an emergency or natural disaster.
- Decide how to allocate emergency preparedness funding.

(1) ACS toolbox

To more easily work with American Community Survey estimates in ArcGIS, we developed the ACS toolbox. This toolbox uses Census specifications detailed in *A Compass for Understanding and Using American Community Survey Data*.



FIPS	Geography	MSJUE	MSJUM	Orig. OID	CompareOID	ZDIFF
3147	Hart County, Georgia	741	187.58978	55	12	3.36025
3149	Heard County, Georgia	282	123.89721	92	12	9
3151	Henry County, Georgia	1636	307.294647	93	12	7.71907
3153	Houston County, Georgia	2515	389.792252	83	12	8.98286
3155	Irwins County, Georgia	214	163.964565	144	12	0.64635
3157	Jackson County, Georgia	1215	264.387972	47	12	5.258025
3159	Jasper County, Georgia	284	169.82632	94	12	0.915889

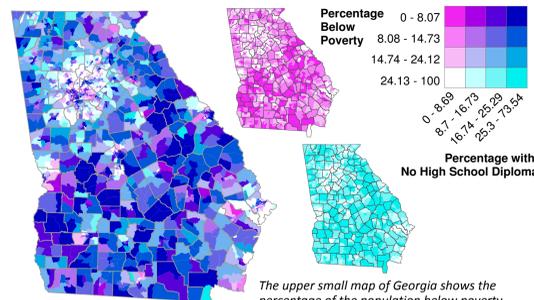
Output of the Statistical Difference - Geo option. The map to the left shows how Heard County, outlined in red, is statistically different from other Georgia counties with respect to the number of children, aged 5 and under, living below the poverty level.

SVI ArcGIS Tools

The SVI toolkit is an evolving set of geoprocessing tools that enable you to work with SVI data as well as other spatial data. Here we highlight four of the tools:

(2) Bivariate Choropleth Mapping

Enables display of two variables on one map.

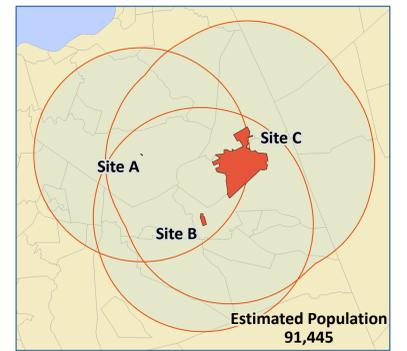


The upper small map of Georgia shows the percentage of the population below poverty, whereas the lower small map shows the percentage with no high school diploma. The large map displays both variables simultaneously.

(1) the ACS toolbox, (2) Bivariate choropleth mapping, (3) the Population Estimator, and (4) the Poisson probability calculator.

(3) Population Estimator

Estimates the population in a user-defined area surrounding a specified feature or features of interest.

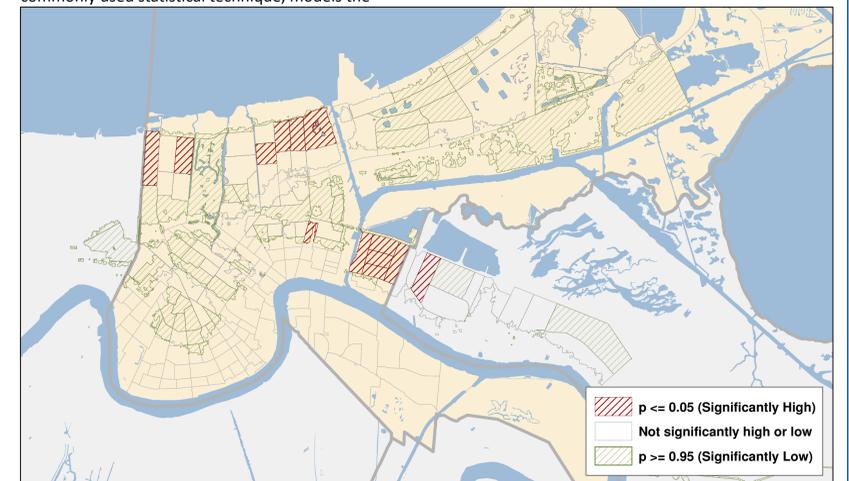


The estimated population within 6 miles of sites A, B, and C, is 91,445.

(4) Poisson Probability Calculator

Probability mapping is one method for dealing with the small numbers problem, which often occurs when working with health data. The Poisson test, a commonly used statistical technique, models the

probability of rare binary events in large populations. Results from the Poisson test can be mapped to determine the distribution of significantly high areas.



Because of the small numbers of drowning deaths from Hurricane Katrina, the calculation of mortality rates isn't statistically valid. The

Poisson test lets us know if the number of deaths per tract is significantly higher than expected based on a regional mortality rate.



Centers for Disease Control and Prevention
Agency for Toxic Substances and Disease Registry